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MILK AND CREAM CONTESTS

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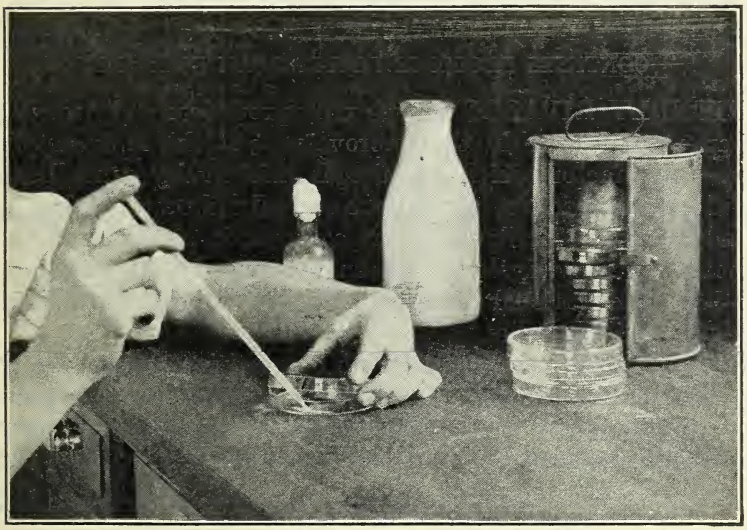

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MILK AND CREAM CONTESTS.[1]

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CONTESTS PROMOTE BETTER MILK SUPPLIES.

FRIENDLY RIVALRY among milk producers and dealers is an important feature in the improvement of the milk supplies of cities. Any factor which encourages this rivalry must be given careful consideration by sanitarians and all milk authorities. Since the inauguration of milk and cream contests, in 1906, this method of promoting friendly rivalry has been recognized. At this time, besides State and National contests, a number of cities use such means for grading milk supplies.

Milk and cream contests promote competition among the dairymen, lead to the grading of milk supplies, and through publicity encourage the efforts of producers as well as educate the consumers regarding the value of good milk and where the best can be obtained.

TWO KINDS OF CONTESTS.

Milk and cream contests are of two kinds—one in which the dairymen prepare their own samples of milk or cream especially for the contest, the date of which is known; the other in which samples are collected on the street without the knowledge of the producers. The first method may or may not indicate the dairymen who generally produce the higher grades of milk. It represents only care in the preparation of samples for definitely known contests. As an educational factor, however, it is very valuable, as it teaches producers care and cleanliness in the production and handling of milk. Of course, in such contests the dairymen take extraordinary care in the production and preparation of the samples, but there is nevertheless an educational value, as shown by the fact that dairymen contesting during several consecutive years usually receive higher scores each succeeding contest. In National and State contests all samples

[1] This circular is a revision of Department Bulletin 356. It is of interest to officials and sanitarians concerned in the control of milk supplies of cities and in a general way to producers of market milk.

are, of necessity, prepared samples. The advertising value of a high score is so great that much interest is always aroused.

On the other hand the surprise contest, especially when it represents samples of milk or cream covering a definite period of time, gives a mathematical rating to each producer based on his everyday product, thereby laying the foundation for grading a city's milk supply. Such contests are valuable in bettering the local milk supply and should be instituted especially in the smaller cities when laboratory facilities are available.

There are three classes of entries in milk and cream contests—certified, raw market, and pasteurized. In grading, these classes must be regarded as entirely distinct, and in the report of results each class must be given separately.

METHOD OF SCORING MILK AND CREAM.

The samples are scored for bacteria, flavor and odor, sediment, fat, solids not fat (in case of milk), temperature or acidity (depending on the kind of contest), and the appearance of the bottle and cap. A perfect score is 100, divided as shown in the score cards following:

[Front.]

UNITED STATES DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.

DAIRY DIVISION.

SCORE CARD FOR MILK.

Place .....

Class ..... Exhibit No. .....

Item.	Perfect score.	Score allowed.	Remarks.
Bacteria	35	.....	Bacteria found per cubic centimeter ——.
Flavor and odor	15	.....	Cowy, bitter, feed, flat, strong, ——.
Sediment	10	.....	——.
Fat	15	.....	Per cent, ——.
Solids not fat	15	.....	Per cent, ——.
Temperature (street samples) or Acidity (prepared samples)	5	.....	Degrees, ——. or Per cent, ——.
Bottle and cap	5	.....	Bottle, ——. Cap, ——.
Total	100	.....	

Exhibitor .....

Address .....

(Signed) .....

.....

.....

Judges.

Date .....

[OVER].

[Back.]

DIRECTIONS FOR SCORING.

BACTERIA PER CUBIC CENTIMETER—PERFECT SCORE, 35.

	Points.		Points.
500 and under	35	20,001-25,000	30
501-1,000	34.9	25,001-30,000	29
1,001-1,500	34.8	30,001-35,000	28
1,501-2,000	34.7	35,001-40,000	27
2,001-2,500	34.6	40,001-45,000	26
2,501-3,000	34.5	45,001-50,000	25
3,001-3,500	34.4	50,001-55,000	24
3,501-4,000	34.3	55,001-60,000	23
4,001-4,500	34.2	60,001-65,000	22
4,501-5,000	34.0	65,001-70,000	21
5,001-6,000	33.8	70,001-75,000	20
6,001-7,000	33.6	75,001-80,000	19
7,001-8,000	33.4	80,001-85,000	18
8,001-9,000	33.2	85,001-90,000	17
9,001-10,000	33.0	90,001-95,000	16
10,001-11,000	32.8	95,001-100,000	15
11,001-12,000	32.6	100,001-120,000	12.5
12,001-13,000	32.4	120,001-140,000	10.0
13,001-14,000	32.2	140,001-160,000	7.5
14,001-15,000	32.0	160,001-180,000	5.0
15,001-20,000	31	180,001-200,000	2.5
		Above 200,000	0

NOTE.—When the number of bacteria per cubic centimeter exceeds the local legal limit the score shall be 0.

FLAVOR AND ODOR—PERFECT SCORE, 15.

Deductions for disagreeable or foreign odor or flavor should be made according to conditions found. When possible to recognize the cause, it should be described under "Remarks."

SEDIMENT—PERFECT SCORE, 10.

Examination for sediment may be made by means of a sediment tester and the resulting cotton disks compared with standards; or the sediment may be determined by examination of the bottom of the milk in the bottle. In the latter case the milk should stand undisturbed for at least an hour before the examination. Raise the bottle carefully in its natural upright position until higher than the head. Tip slightly and observe the bottom of the milk with the naked eye or by the aid of a reading glass. The presence of the slightest movable speck makes a perfect score impossible. Further deductions should be made according to the amount of dirt found. When possible, the nature of the dirt should be described under "Remarks."

FAT IN MILK—PERFECT SCORE, 15.

	Points.		Points.
4.0 per cent and over	15	3.3 per cent	8
3.9 per cent	14	3.2 per cent	7
3.8 per cent	13	3.1 per cent	5
3.7 per cent	12	3.0 per cent	3
3.6 per cent	11	2.9 per cent	1
3.5 per cent	10	Less than 2.9 per cent	0
3.4 per cent	9		

NOTE.—When the per cent of fat is less than the local legal limit the score shall be 0.

SOLIDS NOT FAT—PERFECT SCORE, 15.

	Points.		Points.
8.7 per cent and over	15	8.2 per cent	5
8.6 per cent	13	8.1 per cent	3
8.5 per cent	11	8 per cent	1
8.4 per cent	9	Less than 8 per cent	0
8.3 per cent	7		

NOTE.—When the per cent of solids not fat is less than the local legal limit the score shall be 0.

TEMPERATURE (STREET SAMPLES)—PERFECT SCORE, 5.

	Points.		Points.
50° F. or below	5	57 to 60°	1
51 to 53°	4	Above 60°	0
54 to 56°	3		

[Back—Continued.]

ACIDITY (PREPARED SAMPLES)—PERFECT SCORE, 5.

	Points.		Points.
0.2 per cent or less	5	0.23 per cent	2
0.21 per cent	4	0.24 per cent	1
0.22 per cent	3	More than 0.24 per cent	0

BOTTLE AND CAP—PERFECT SCORE, 5.

Deductions in score should be made for dirty or chipped bottles or for caps which do not cover the lips of the bottles or do not fit properly in the cap seats.

[Front.]

UNITED STATES DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.

DAIRY DIVISION.

SCORE CARD FOR CREAM.

Place.....

Class.....Exhibit No.....

Item.	Perfect score.	Score allowed.	Remarks.
Bacteria	35		Bacteria found per cubic centimeter
Flavor and odor	25		Cowy, bitter, feed, flat, strong
Sediment	10		
Fat	20		Per cent
Temperature (street samples)	5		Degrees
or			or
Acidity (prepared samples)			Per cent
Bottle and cap	5		Cap
			Bottle
Total	100		

Exhibitor.....

Address.....

(Signed).....

.....

.....

Judges.

Date.....

[OVER.]

[Back.]

DIRECTIONS FOR SCORING.

BACTERIA PER CUBIC CENTIMETER—PERFECT SCORE, 35.

	Points.		Points.
Under 500	35	25,001–30,000	29
501–1,000	34.9	30,001–35,000	28
1,001–1,500	34.8	35,001–40,000	27
1,501–2,000	34.7	40,001–45,000	26
2,001–2,500	34.6	45,001–50,000	25
2,501–3,000	34.5	50,001–55,000	24
3,001–3,500	34.4	55,001–60,000	23
3,501–4,000	34.3	60,001–65,000	22
4,001–4,500	34.2	65,001–70,000	21
4,501–5,000	34	70,001–75,000	20
5,001–6,000	33.8	75,001–80,000	19
6,001–7,000	33.6	80,001–85,000	18
7,001–8,000	33.4	85,001–90,000	17
8,001–9,000	33.2	90,001–95,000	16
9,001–10,000	33	95,001–100,000	15
10,001–11,000	32.8	100,001–120,000	12.5
11,001–12,000	32.6	120,001–140,000	10
12,001–13,000	32.4	140,001–160,000	7.5
13,001–14,000	32.2	160,001–180,000	5
14,001–15,000	32	180,001–200,000	2.5
15,001–20,000	31	Above 200,000	0
20,001–25,000	30		

NOTE.—When the number of bacteria per cubic centimeter exceeds the local legal limit, the score shall be 0.

FLAVOR AND ODOR—PERFECT SCORE, 25.

Deductions for disagreeable or foreign odor or flavor should be made according to conditions found. When possible to recognize the cause, it should be described under "Remarks."

SEDIMENT—PERFECT SCORE, 10.

Examination for sediment should be made only after the cream has stood for at least an hour undisturbed in any way. Raise the bottle carefully in its natural upright position, until higher than the head. Tip slightly and observe the bottom of the cream with the naked eye or by the aid of a reading glass. The presence of the slightest movable speck makes a perfect score impossible. Further deductions should be made according to the amount of dirt found. When possible the nature of the dirt should be described under "Remarks."

FAT IN CREAM—PERFECT SCORE, 20.

	Points.		Points.
25 per cent or above	20	19 per cent	17
24 per cent	19.5	18 per cent	16
23 per cent	19	17 per cent	12
22 per cent	18.5	16 per cent	8
21 per cent	18	15 per cent	4
20 per cent	17.5	Less than 15 per cent	0

NOTE.—When the per cent of fat is less than the local legal limit the score shall be 0.

TEMPERATURE (STREET SAMPLES)—PERFECT SCORE, 5.

	Points.		Points.
50 degrees F. or below	5	57 to 60	1
51 to 53	4	Above 60	0
54 to 56	3		

ACIDITY (PREPARED SAMPLES)—PERFECT SCORE, 5.

	Points.		Points.
0.2 per cent and less	5	0.23 per cent	2
0.21 per cent	4	0.24 per cent	1
0.22 per cent	3	More than 0.24 per cent	0

BOTTLE AND CAP—PERFECT SCORE, 5.

Deductions in score should be made for dirty, chipped bottles; for caps which do not cover the lips of the bottles or do not fit properly in the cap seats.

CONTESTS IN WHICH SAMPLES ARE PREPARED BY CONTESTANTS.

Before definitely announcing the time and details for holding milk and cream contests, the persons in charge should arrange to obtain prizes for the contestants. This is important, since there should be an additional incentive for the producers besides the desire of winning the contests. In local contests such city organizations as the Chamber of Commerce, the Rotary Club, civic leagues, or women's clubs might be interested in furnishing prizes, such as money, cups, or even dairy equipment. Interested commercial firms may easily be persuaded to give prizes.

After details of the contest are arranged, general publicity can be given through local newspapers. It is best, however, not to depend too much upon this kind of publicity but to send preliminary notices to the dairymen themselves, as a great deal of individual effort usually is needed in interesting the producers. Each prospective contestant should receive an entry blank, the filling out and sending in of which must be made prerequisite to the entering of samples of milk or cream in the contest.

SAMPLE ENTRY BLANK.

DEPARTMENT OF HEALTH.

CITY OF .....

OFFICIAL ENTRY BLANK.

MILK AND CREAM CONTEST.

Held at.....from.....to.....
(Place.)

Under the direction of.....

The following classes are provided:

Class I. Raw market milk.
Class II. Certified milk.
Class III. Pasteurized market milk.
Class IV. Raw market cream.
Class V. Pasteurized market cream.

RULES.

1. Competition is open to all milk and cream producers and distributors supplying milk and cream to.....
2. Only one entry may be made in any one class.
3. Producers of certified milk are barred from competition in any other class.
4. All samples of certified milk must be accompanied with a certificate issued by the medical milk commission under whose supervision the milk is produced.
5. Entries in milk classes consist of 4 pints of milk in pint bottles.
6. Entries in cream classes consist of 4 one-half pints of cream in half-pint bottles.
7. All entries of milk and cream after scoring become the property of the department of health of .....
8. No contestant will be entitled to placing who does not make answer to each question herein given, sign declaration and forward this official entry blank to....., ...
(Name.) (Address.)

HOW TO COMPETE.

Milk or cream to compete in this contest must be delivered or shipped, prepaid, to .....

In order that all milk and cream entered by contestants may be of the same age when scored, all samples must be produced or prepared on ..... (Date.) and shipped immediately. Bottles should be carefully packed in ice in a proper shipping box, and this box marked plainly on the inside cover as well as on the outside with the owner's name and address.

An official representative of the judges will receive all samples and place them at once in cold storage.

APPLICATION AND QUESTIONS TO BE ANSWERED.

Please enter for me four (pint) bottles of ..... ($\frac{1}{2}$ pint) to compete in class ..... in accordance with conditions herein prescribed.

FOR CLASSES I, II, AND IV.

1. On what day and hour was the sample entered in this contest drawn?.....
2. How many cows contributed to the sample of milk entered? .....
3. What kind and quality of feed was given cows daily during the week preceding the production of the sample? .....
4. How were cows cleaned previous to milking? .....
5. What kind of pail was used, small-top or open? .....
6. How were the utensils sterilized? .....
7. What method of straining was used? .....
8. How was the milk cooled? .....
   How long after milking?..... To what temperature? .....
9. Have you previously exhibited milk or cream at any local, State, or National show .....
10. (Additional for cream). How was the sample separated? .....
    ..... How was the separator cleaned? .....
11. (Additional for certified.) Give name and address of medical milk commission certifying to your product. .....

FOR CLASSES III AND V.

12. When was the sample pasteurized?.....
13. What was the average age of the product at the time of pasteurization?.....
14. Did you use a clarifier? .....
15. To what temperature was the product heated? .....
16. How long was it held at that temperature? .....
17. Do you use automatic temperature control and recording thermometers? .....
18. To what temperature was the product cooled? .....
19. How was the pasteurizing apparatus cleaned? .....

I, ..., do hereby declare each and every statement in answer to the foregoing questions to be true. I do furthermore declare that the product submitted by me is the pure natural product, free from preservatives, and (for Classes I, II, and IV) that it has not been heated or changed in any way.

Date ..... (Name) .....

(Address) .....

Do you wish shipping box returned at your expense? .....

PREPARATION OF SAMPLES.

The person in charge of the contest should issue detailed instructions regarding packing and delivery. Express charges should be paid by consignor. Contests with prepared samples would be fairer and results more valuable if the sample represented the milk of the entire herd. In some contests this is required. Generally, however, entries representing the product of one or more cows may be furnished. Usually great care is taken to obtain the sample under as near sterile conditions as possible. Thorough washing of the udder and the hands of the milker is necessary, and a properly sterilized, small-top pail should be used. Sterile absorbent cotton or filter cloth is the best material to use for straining milk.

It is not advisable to pour the milk, while still warm, into the final container, as the shrinkage when cold leaves some space between the milk and the cap. This may detract from the appearance of the bottle, and churning may result. It is suggested that the milk be strained into a sterile container and cooled, special care being taken to avoid contamination. The milk, after mixing, may then be poured into sterile pint bottles and the caps put on. Caps may be sterilized by dipping into melted paraffin, but care should be taken not to heat the paraffin too much, as it gives off odors at high temperatures. When the cap is placed firmly into the cap seat of the bottle, some melted paraffin may be poured on. The top of the bottle should be protected by means of a cap cover. When filled and capped the bottles must be packed immediately in ice and kept cold but not frozen, until ready for examination. An ice-and-salt mixture for cooling should never be used, as it may freeze the samples.

SHIPPING THE SAMPLES.

If the samples are to be shipped, special care must be taken in labeling and packing. In local contests the contestants usually bring in their own samples, properly iced, but when shipping is necessary great care should be taken to pack the samples so that they will remain cold and there will be no breakage. One method is to place the samples in a small, close-fitting container, which, in turn, is securely fastened in an insulated box containing cracked ice. The outer box may be insulated with cork or sawdust. The owner's name and address should be plainly written on the inside of the cover of the outer box. The package must be plainly addressed on the outside to the consignee and bear the sender's name and address.

HANDLING SAMPLES AT DESTINATION.

As soon as received at the place where the contest is to be held the sample should be put into cold storage at a temperature between 35° and 40° F. until ready for examination. When the shipping

boxes are opened the name and address of the consignee (producer) are taken and each of the bottles tagged with its class and number. The name of the contestant, the class of the product, and the number given are placed in an envelope and the envelope sealed. On the outside of this sealed envelope the number of the sample and the class are placed. The person in charge of the contest should keep the records, and it is desirable for the judges to know the samples only by numbers.

As there are four bottles in each entry one may be used for chemical analysis; one for bacteriological examination and sediment; one for judging flavor, odor, and appearance; and one held in reserve to be placed on exhibition. This method may be varied to meet special conditions.

The best sample in each class must be declared the winner of that class, provided, of course, that all conditions have been complied with. In case of ties in the total score, the entry having the lowest bacteria count should outrank the others. Samples of high merit that have not won a prize may be awarded a diploma or certificate bearing the seal of the health department. The following form may be used:

DIPLOMA OF MERIT.

The Health Department
of the City of .....
Awards a Diploma of Merit
to
.....

For a sample of ..... scoring ....., exhibit at the ..... held at.....
.....

Judges:

.....
.....
.....

(Signed) .....

[SEAL.] *Superintendent of Contest.*

The persons in charge of the contest should furnish contestants with detailed copies of their scores, and be ready to answer questions regarding them. As the principal reason for holding the contests is to improve the milk supply, authorities should take advantage of the data furnished by dairymen to point out faults in the production and handling of the milk or cream and advise ways to improve the quality.

CONTESTS IN WHICH SAMPLES ARE TAKEN ON THE STREET.

This method of conducting milk contests, if properly carried out, furnishes a basis for grading the milk supply of cities. As in the contests with prepared samples, the three classes—pasteurized and raw market milk and cream and certified milk—must be kept separate.

COLLECTING THE SAMPLES.

At least once a month, and oftener if possible, the health department should collect 2 pint bottles of milk and 2 half-pint bottles of cream from each person delivering milk or cream in the city. At the time of collection one of the samples should be well mixed, the bottle opened, and the temperature of the milk or cream taken. This sample should be properly marked so as not to be used for bacteriological examination, but used later for chemical determinations. Both samples should be placed immediately in ice until ready for analysis. The following determinations are made: Bacteria, sediment, specific gravity, fat, solids not fat, flavor and odor, and condition of bottle and cap.

Careful records of the determinations as well as the temperature of the milk or cream at time of collection should be made and properly filed.

FILE CARD FOR RECORDING MILK SCORES.

Name of dairy..... Class.....
Name of owner.....
Place..... P. O. address .....

Date sample taken.	Bacteria per cubic centimeter.	Flavor and odor score and remarks.	Sediment score.	Specific gravity at 60° F.	Fat.	Solids not fat.	Temperature on street. Degrees F.	Bottle and cap score.	Remarks.
					Per cent.	*Per cent.*			

After a definite period of time—for example, 3, 6, or 12 months—the determinations made on the samples of each dairyman are averaged; these averages constitute a new record which is transferred to the milk or cream card and scored. The scores allowed each point are added together to make the total score. At the end of the period the names of the dairymen are published in the order of their scores, the highest in each class coming first.

For the purpose of grading, the dairymen of each class scoring above 90 may be put in the same grade; those scoring between 80 and 90 in another grade; and those scoring below 80 in another, thus making three grades in each class.

LABORATORY EQUIPMENT FOR CONDUCTING CONTESTS.

It is evident that the health department of a city must have proper laboratory equipment in order to conduct milk and cream contests. The following is a guide for the equipment of an average laboratory for doing such work. Quantities of the supplies may be varied according to the amount of work to be done.

CHEMICAL EQUIPMENT.

Babcock milk tester, 8 to 24 bottles, for fat determinations.
Westphal balance or accurate lactometer with cylinder for specific gravity determination.
Milk-test bottles, 8 per cent, for fat in milk.
Cream-test bottles, 9 grams, 50 per cent, for fat in cream.
Cream-test scales for weighing cream.
Pair dividers.
Pipettes, 17.6 cubic centimeters, for measuring milk or acid.
Combined acid bottle and pipette.
Burette, 50 cubic centimeters, glass stopcock, graduated in tenths, for acidity determination.
Glass stirring rods for acidity determination.
Burette holder.
Beakers, 100 cubic centimeters, for flavor and odor and acidity.
Sediment tester for dirt in milk.
Cotton disks for sediment.
Fahrenheit dairy thermometers for temperature of samples on collection.
Bunsen burners, gas, with rubber tubing.
Commercial sulphuric acid for fat determination.
Sodium hydroxid, tenth-normal solution, for acidity.
Phenolphthalein indicator for acidity determination.

BACTERIOLOGICAL EQUIPMENT.

Autoclav, medium size, for steam sterilization.
Sterilizing oven for dry-air sterilization.
Incubator, for growing bacteria.
Water bath for melting agar tubes.
For preparation of media:
- Balance, with weights to 5 kilos.
- Double boiler, one-half gallon.
- Funnel glass, 6 inches in diameter.
- Burette, 50 cubic centimeters, glass stopcock, graduated in tenths.
- Gas stove, single burner.

1-cubic centimeter pipettes to deliver between 2 marks, graduated in tenths with extra tenth above 0 mark, for measuring dilutions.
Test tubes, lipless, for holding 10 cubic centimeters media.
Test-tube baskets.
For measuring liquids:
- 5 cubic centimeter pipette.
- 10 cubic centimeter pipette.
- 25 cubic centimeter pipette.
- 50 cubic centimeter pipette.
- 100 cubic centimeter cylinder, graduated.
- 500 cubic centimeter cylinder, graduated.
- 1,000 cubic centimeter cylinder, graduated.

Petri dishes for plating samples.
Glass bottles, 8-ounce, for sterile dilution water.
Thermometer (−10° to +110° C.) for temperatures in laboratory operations.
Thermometer (−10° to +200° C.) for dry-air ovens.
Pipette boxes, copper orgalvanized iron, for holding 1-cubic centimeter pipettes.

For counting bacteria:
- Reading glass, 4-inch, 2½ magnifications.
- Counting plate.
- Tally machine.
- Wax pencil.

Absorbent cotton for filtering media.
Nonabsorbent cotton for plugging test tubes.
Canton flannel for filtering media.
For making media:
- Peptone; beef extract; agar, shredded.

For adjusting media:
- Sodium hydroxid, normal.
- Sodium hydroxid, tenth normal.
- Hydrochloric acid, tenth normal.
- Phenolphthalein indicator.

METHODS OF ANALYZING AND TESTING.

It is of special importance in all analytical work that the standard methods prescribed be followed. No attempt is made here to give details of milk analysis, as every laboratory equipped to do this kind

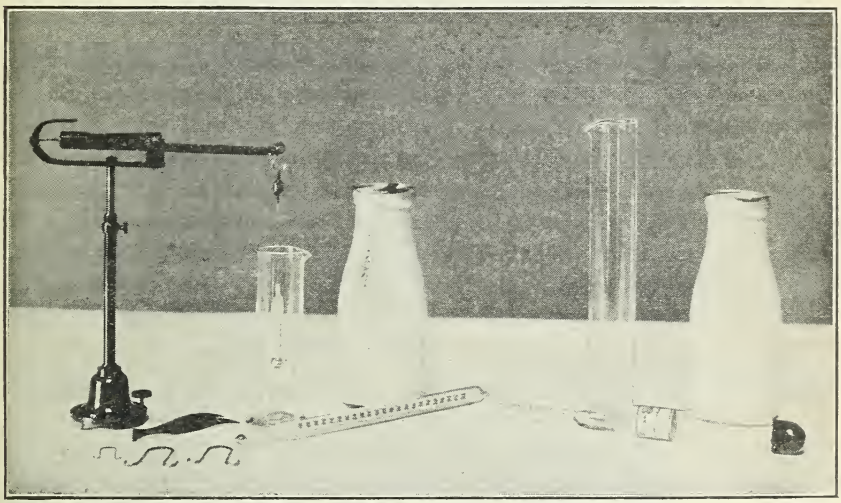

FIG. 1.—Westphal balance and lactometer for determining specific gravity of milk.

of work must certainly contain the proper reference books. Besides the usual books found in all health or food laboratories the analyst should have the following pamphlets:

Chemical Testing of Milk and Cream, Bureau of Animal Industry, Leaflet A 12, U. S. Department of Agriculture, Washington, D. C.

Official and Provisional Methods of Analysis, Association of Official Agricultural Chemists, Bureau of Chemistry Bulletin 107, Revised, U. S. Department of Agriculture, Washington, D. C.

Testing Milk and Cream for Butterfat, Circular 78, Purdue University Agricultural Experiment Station, La Fayette, Ind.

Standard Methods of Bacteriological Analysis of Milk, Provisional Report of the Laboratory Section of the American Public Health Association, 126 Massachusetts Avenue, Boston, Mass.

SPECIFIC GRAVITY.

The determination of specific gravity should be made either by a Westphal balance or by an accurately graduated lactometer. (Fig. 1.) The importance of accuracy in taking the specific gravity is better understood when it is realized that from the specific gravity and the fat found, the total solids or solids not fat are calculated. As most of the lactometers are standardized to 60° F. (15° C.), it is important that the temperature of the milk to be tested should closely approximate this temperature. If it is necessary to take the readings at some other temperature, the following table of correction, by Dr. Paul Vieth, should be used.

Table for correcting the specified gravity of milk according to temperature.

Degrees of lactometer.	Degrees of thermometer (Fahrenheit).															
	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
20	19.0	19.0	19.1	19.1	19.2	19.2	19.3	19.4	19.4	19.5	19.6	19.7	19.8	19.9	19.9	.....
21	19.9	20.0	20.0	20.1	20.2	20.3	20.3	20.3	20.4	20.5	20.6	20.7	20.8	20.9	20.9	.....
22	20.9	21.0	21.0	21.1	21.2	21.2	21.3	21.3	21.4	21.5	21.6	21.7	21.8	21.9	21.9	.....
23	21.9	22.0	22.0	22.1	22.2	22.2	22.3	22.3	22.4	22.5	22.6	22.7	22.8	22.8	22.9	.....
24	22.9	22.9	23.0	23.1	23.2	23.2	23.3	23.3	23.4	23.5	23.6	23.6	23.7	23.8	23.9	.....
25	23.8	23.9	24.0	24.0	24.1	24.1	24.2	24.3	24.4	24.5	24.6	24.6	24.7	24.8	24.9	.....
26	24.8	24.9	24.9	25.0	25.1	25.1	25.2	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	.....
27	25.8	25.9	25.9	26.0	26.1	26.1	26.2	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	.....
28	26.7	26.8	26.8	26.9	27.0	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	.....
29	27.7	27.8	27.8	27.9	28.0	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	.....
30	28.6	28.7	28.7	28.8	28.9	29.0	29.1	29.1	29.2	29.3	29.4	29.6	29.7	29.8	29.9	.....
31	29.5	29.6	29.6	29.7	29.8	29.9	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.8	30.9	.....
32	30.4	30.5	30.5	30.6	30.7	30.9	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.9	.....
33	31.3	31.4	31.4	31.5	31.6	31.8	31.9	32.0	32.1	32.3	32.4	32.5	32.6	32.7	32.9	.....
34	32.2	32.3	32.3	32.4	32.5	32.7	32.9	33.0	33.1	33.2	33.3	33.5	33.6	33.7	33.9	.....
35	33.0	33.1	33.2	33.4	33.5	33.6	33.8	33.9	34.0	34.2	34.3	34.5	34.6	34.7	34.9	.....

Degrees of lactometer.	Degrees of thermometer.														
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
20	20.1	20.2	20.2	20.3	20.4	20.5	20.6	20.7	20.9	21.0	21.1	21.2	21.3	21.5	21.6
21	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	22.0	22.1	22.2	22.3	22.4	22.5	22.6
22	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	23.0	23.1	23.2	23.3	23.4	23.5	23.7
23	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	24.0	24.1	24.2	24.3	24.4	24.6	24.7
24	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.9	25.0	25.1	25.2	25.3	25.5	25.6	25.7
25	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.9	26.0	26.1	26.2	26.4	26.5	26.6	26.8
26	26.1	26.2	26.3	26.5	26.6	26.7	26.8	27.0	27.1	27.2	27.3	27.4	27.5	27.7	27.8
27	27.1	27.3	27.4	27.5	27.6	27.7	27.8	28.0	28.1	28.2	28.3	28.4	28.6	28.7	28.9
28	28.1	28.3	28.4	28.5	28.6	28.7	28.8	29.0	29.1	29.2	29.4	29.5	29.7	29.8	29.9
29	29.1	29.3	29.4	29.5	29.6	29.8	29.9	30.1	30.2	30.3	30.4	30.5	30.7	30.9	31.0
30	30.1	30.3	30.4	30.5	30.7	30.8	30.9	31.1	31.2	31.3	31.5	31.6	31.8	31.9	32.1
31	31.2	31.3	31.4	31.5	31.7	31.7	31.8	32.0	32.2	32.4	32.5	32.6	32.8	33.0	33.1
32	32.2	32.3	32.5	32.6	32.7	32.9	33.0	33.2	33.3	33.4	33.6	33.7	33.9	34.0	34.2
33	33.2	33.3	33.5	33.6	33.8	33.9	34.0	34.2	34.3	34.5	34.6	34.7	34.9	35.1	35.2
34	34.2	34.3	34.5	34.6	34.8	34.9	35.0	35.2	35.3	35.5	35.6	35.8	36.0	36.1	36.3
35	35.2	35.3	35.5	35.6	35.8	35.9	36.1	36.2	36.4	36.5	36.7	36.8	37.0	37.2	37.3

The milk to be tested for specific gravity should be well mixed either by gently inverting the bottle several times or by pouring back and forth from the bottle to a beaker. In mixing the milk, as

well as in pouring into a cylinder for the determination of the specific gravity, care should be taken to avoid the formation of air bubbles.

In using the lactometer a meniscus is formed at the point where the stem comes in contact with the milk. The point to be read is at the actual surface of the liquid and not at the top of the meniscus.

MILKFAT (BUTTERFAT).

In order to distribute the fat evenly the bottle of milk or cream must be well mixed, preferably by pouring back and forth from the bottle to a beaker. This should be done just before the product for analysis is measured out. The charge of milk consists of 17.6 cubic centimeters and is measured; the cream charge consists of 9 or 18 grams and is always weighed.

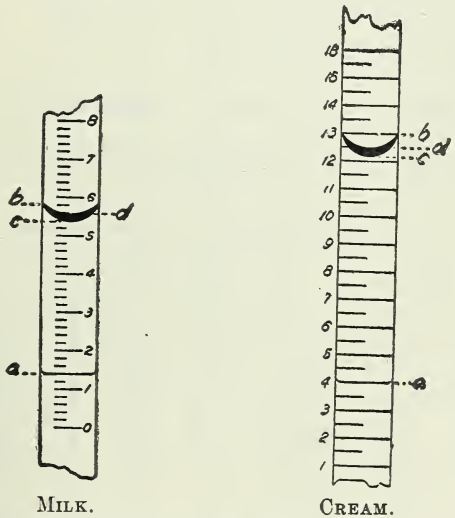

FIG. 2.—Method of reading Babcock test bottles. In reading fat column in milk testing, read from *a* to *b*, not *a* to *c*, nor *a* to *d*. In cream testing, read from *a* to *c*, not *a* to *b*, nor *a* to *d*.

The Babcock tester must be run at a definite speed, depending upon the diameter of the centrifuge. The proper speed is usually indicated on the machine and runs about as follows: 1,000 revolutions a minute for 12-inch testers, and 800 revolutions for 18-inch testers. The samples should be run three times for 5, 2, and 1 minute periods, respectively. Hot water is added to bring the solution up to the neck of the bottle after the 5-minute period.

The fat column should be clear, with a yellow or light-yellow color. If the fat column contains white flakes (the result of too weak or too little acid) or black flakes (the result of too strong or too much acid), the test must be repeated. Before the reading is taken the bottles with their columns of fat must be placed in water approximating 140° F. (60° C.), so that the fat column is surrounded

by the hot water. They should remain in the bath about 10 minutes and be read, one by one, immediately on removal. In measuring the fat column in the milk test, read from the bottom to the extreme top of the meniscus. In measuring the fat column in the cream test, read from the bottom to the lower part of the meniscus. However, in the case of cream a more accurate reading can be obtained by adding a few drops of glymol to the cream test bottle on removal from the water bath. This flattens the meniscus and makes reading easier.

SOLIDS NOT FAT.

The solids not fat may be determined by the formula S. N. F. = $\frac{1}{4}$ L. + .2F, in which "L" stands for the third and the fourth figures of the specific gravity and "F" stands for the percentage of fat.

Example: Specific gravity at 60° F., 1.032; fat, 4 per cent.

$$\frac{32}{4}+0.2\times4=8.80 \text{ solids not fat.}$$

The following table may be used for estimating the solids not fat:

Table for determining the solids not fat in milk from any given specific gravity and per cent of fat.

Per cent of fat.	Lactometer reading at 60° F. (Quevenne degrees).										
	26	27	28	29	30	31	32	33	34	35	36
2.00	6.90	7.15	7.40	7.65	7.90	8.15	8.40	8.66	8.91	9.16	9.41
2.05	6.91	7.16	7.41	7.66	7.91	8.16	8.41	8.67	8.92	9.17	9.42
2.10	6.92	7.17	7.42	7.67	7.92	8.17	8.42	8.68	8.93	9.18	9.43
2.15	6.93	7.18	7.43	7.68	7.93	8.18	8.43	8.69	8.94	9.19	9.44
2.20	6.94	7.19	7.44	7.69	7.94	8.19	8.44	8.70	8.95	9.20	9.45
2.25	6.95	7.20	7.45	7.70	7.95	8.20	8.45	8.71	8.96	9.21	9.46
2.30	6.96	7.21	7.46	7.71	7.96	8.21	8.46	8.72	8.97	9.22	9.47
2.35	6.97	7.22	7.47	7.72	7.97	8.22	8.47	8.73	8.98	9.23	9.48
2.40	6.98	7.23	7.48	7.73	7.98	8.23	8.48	8.74	8.99	9.24	9.49
2.45	6.99	7.24	7.49	7.74	7.99	8.24	8.49	8.75	9.00	9.25	9.50
2.50	7.00	7.25	7.50	7.75	8.00	8.25	8.50	8.76	9.01	9.26	9.51
2.55	7.01	7.26	7.51	7.76	8.01	8.26	8.51	8.77	9.02	9.27	9.52
2.60	7.02	7.27	7.52	7.77	8.02	8.27	8.52	8.78	9.03	9.28	9.53
2.65	7.03	7.28	7.53	7.78	8.03	8.28	8.53	8.79	9.04	9.29	9.54
2.70	7.04	7.29	7.54	7.79	8.04	8.29	8.54	8.80	9.05	9.30	9.55
2.75	7.05	7.30	7.55	7.80	8.05	8.30	8.56	8.81	9.06	9.31	9.56
2.80	7.06	7.31	7.56	7.81	8.06	8.31	8.57	8.82	9.07	9.32	9.57
2.85	7.07	7.32	7.57	7.82	8.07	8.32	8.58	8.83	9.08	9.33	9.58
2.90	7.08	7.33	7.58	7.83	8.08	8.33	8.59	8.84	9.09	9.34	9.59
2.95	7.09	7.34	7.59	7.84	8.09	8.35	8.60	8.85	9.10	9.35	9.60
3.00	7.10	7.35	7.60	7.85	8.10	8.36	8.61	8.86	9.11	9.36	9.61
3.05	7.11	7.36	7.61	7.86	8.12	8.37	8.62	8.87	9.12	9.37	9.63
3.10	7.12	7.37	7.62	7.87	8.13	8.38	8.63	8.88	9.13	9.38	9.64
3.15	7.13	7.38	7.63	7.88	8.14	8.39	8.64	8.89	9.14	9.40	9.65
3.20	7.14	7.39	7.64	7.89	8.15	8.40	8.65	8.90	9.15	9.41	9.66
3.25	7.15	7.40	7.65	7.91	8.16	8.41	8.66	8.91	9.17	9.42	9.67
3.30	7.16	7.41	7.66	7.92	8.17	8.42	8.67	8.92	9.18	9.43	9.68
3.35	7.17	7.42	7.68	7.93	8.18	8.43	8.68	8.93	9.19	9.44	9.69
3.40	7.18	7.43	7.69	7.94	8.19	8.44	8.69	8.94	9.20	9.45	9.70
3.45	7.19	7.44	7.70	7.95	8.20	8.45	8.70	8.95	9.21	9.46	9.71
3.50	7.20	7.45	7.71	7.96	8.21	8.46	8.71	8.96	9.22	9.47	9.72
3.55	7.21	7.47	7.72	7.97	8.22	8.47	8.72	8.97	9.23	9.48	9.73
3.60	7.22	7.48	7.73	7.98	8.23	8.48	8.73	8.98	9.24	9.49	9.74
3.65	7.23	7.49	7.74	7.99	8.24	8.49	8.74	8.99	9.25	9.50	9.75
3.70	7.24	7.50	7.75	8.00	8.25	8.50	8.75	9.00	9.26	9.51	9.76
3.75	7.25	7.51	7.76	8.01	8.26	8.51	8.76	9.01	9.27	9.52	9.77
3.80	7.26	7.52	7.77	8.02	8.27	8.52	8.77	9.02	9.28	9.53	9.78
3.85	7.27	7.53	7.78	8.03	8.28	8.53	8.78	9.03	9.29	9.54	9.79
3.90	7.28	7.54	7.79	8.04	8.29	8.54	8.79	9.04	9.30	9.55	9.80
3.95	7.29	7.55	7.80	8.05	8.30	8.55	8.80	9.05	9.31	9.56	9.82

Table for determining the solids not fat in milk from any given specific gravity and per cent of fat—Continued.

Per cent of fat.	Lactometer reading at 60° F. (Quevenne degrees).										
	26	27	28	29	30	31	32	33	34	35	36
4.00	7.30	7.56	7.81	8.06	8.31	8.56	8.81	9.06	9.32	9.57	9.83
4.05	7.31	7.57	7.82	8.07	8.32	8.57	8.82	9.07	9.33	9.58	9.84
4.10	7.32	7.58	7.83	8.08	8.33	8.58	8.83	9.08	9.34	9.59	9.85
4.15	7.33	7.59	7.84	8.09	8.34	8.59	8.84	9.10	9.35	9.61	9.86
4.20	7.34	7.60	7.85	8.10	8.35	8.60	8.85	9.11	9.36	9.62	9.87
4.25	7.35	7.61	7.86	8.11	8.36	8.61	8.87	9.12	9.37	9.63	9.88
4.30	7.36	7.62	7.87	8.12	8.37	8.62	8.88	9.13	9.38	9.64	9.89
4.35	7.37	7.63	7.88	8.13	8.38	8.63	8.89	9.14	9.39	9.65	9.90
4.40	7.38	7.64	7.89	8.14	8.39	8.64	8.90	9.15	9.40	9.66	9.91
4.45	7.39	7.65	7.90	8.15	8.40	8.65	8.91	9.16	9.41	9.67	9.92
4.50	7.40	7.66	7.91	8.16	8.41	8.66	8.92	9.17	9.42	9.68	9.93
4.55	7.42	7.67	7.92	8.17	8.42	8.67	8.93	9.18	9.43	9.69	9.94
4.60	7.43	7.68	7.93	8.18	8.43	8.68	8.94	9.19	9.40	9.70	9.95
4.65	7.44	7.69	7.94	8.19	8.44	8.69	8.95	9.20	9.45	9.71	9.96
4.70	7.45	7.70	7.95	8.20	8.45	8.70	8.96	9.21	9.46	9.72	9.97
4.75	7.46	7.71	7.96	8.21	8.46	8.71	8.97	9.22	9.47	9.73	9.98
4.80	7.47	7.72	7.97	8.22	8.47	8.72	8.98	9.23	9.48	9.74	9.99
4.85	7.48	7.73	7.98	8.23	8.48	8.73	8.99	9.24	9.49	9.75	10.00
4.90	7.49	7.74	7.99	8.24	8.49	8.74	9.00	9.25	9.50	9.76	10.01
4.95	7.50	7.75	8.00	8.25	8.50	8.75	9.01	9.26	9.51	9.77	10.02
5.00	7.51	7.76	8.01	8.26	8.51	8.76	9.02	9.27	9.52	9.78	10.03
5.05	7.52	7.77	8.02	8.27	8.52	8.78	9.03	9.28	9.53	9.79	10.04
5.10	7.53	7.78	8.03	8.28	8.53	8.79	9.04	9.29	9.54	9.80	10.05
5.15	7.54	7.79	8.04	8.29	8.54	8.80	9.05	9.30	9.55	9.81	10.06
5.20	7.55	7.80	8.05	8.30	8.55	8.81	9.06	9.31	9.56	9.82	10.07
5.25	7.56	7.81	8.06	8.31	8.56	8.82	9.07	9.32	9.57	9.83	10.08
5.30	7.57	7.82	8.07	8.32	8.57	8.83	9.08	9.33	9.58	9.84	10.09
5.35	7.58	7.83	8.08	8.33	8.58	8.84	9.09	9.35	9.60	9.85	10.10
5.40	7.59	7.84	8.09	8.34	8.60	8.85	9.10	9.36	9.61	9.86	10.11
5.45	7.60	7.85	8.10	8.35	8.61	8.86	9.11	9.37	9.62	9.87	10.12
5.50	7.61	7.86	8.11	8.36	8.62	8.87	9.12	9.38	9.63	9.88	10.13
5.55	7.62	7.87	8.12	8.38	8.63	8.88	9.14	9.39	9.64	9.89	10.14
5.60	7.63	7.88	8.13	8.39	8.64	8.89	9.15	9.40	9.65	9.90	10.15
5.65	7.64	7.89	8.14	8.40	8.65	8.90	9.16	9.41	9.66	9.91	10.16
5.70	7.65	7.90	8.15	8.41	8.66	8.91	9.17	9.42	9.67	9.92	10.17
5.75	7.66	7.91	8.16	8.42	8.67	8.93	9.18	9.43	9.68	9.93	10.18
5.80	7.67	7.92	8.17	8.43	8.68	8.94	9.19	9.44	9.69	9.94	10.19
5.85	7.68	7.93	8.19	8.44	8.69	8.95	9.20	9.45	9.70	9.95	10.21
5.90	7.69	7.94	8.20	8.45	8.70	8.96	9.21	9.46	9.71	9.96	10.22
5.95	7.70	7.95	8.21	8.46	8.71	8.97	9.22	9.47	9.72	9.97	10.23
6.00	7.71	7.96	8.22	8.47	8.72	8.98	9.23	9.48	9.73	9.98	10.24
6.05	7.72	7.97	8.23	8.48	8.73	8.99	9.24	9.49	9.74	9.99	10.25
6.10	7.73	7.98	8.24	8.49	8.74	9.00	9.25	9.50	9.75	10.00	10.26
6.15	7.74	7.99	8.25	8.50	8.75	9.01	9.26	9.51	9.76	10.01	10.27
6.20	7.75	8.00	8.26	8.51	8.76	9.02	9.27	9.52	9.77	10.02	10.28
6.25	7.76	8.01	8.27	8.52	8.77	9.03	9.28	9.53	9.78	10.03	10.29
6.30	7.77	8.02	8.28	8.53	8.78	9.04	9.29	9.54	9.79	10.04	10.30
6.35	7.78	8.03	8.29	8.55	8.79	9.05	9.30	9.55	9.80	10.05	10.31
6.40	7.79	8.04	8.30	8.56	8.80	9.06	9.31	9.56	9.81	10.06	10.32
6.45	7.80	8.05	8.31	8.57	8.81	9.07	9.32	9.57	9.82	10.07	10.33
6.50	7.81	8.06	8.32	8.58	8.82	9.08	9.33	9.58	9.83	10.08	10.34
6.55	7.82	8.07	8.33	8.59	8.83	9.09	9.34	9.59	9.84	10.09	10.35
6.60	7.83	8.08	8.34	8.60	8.84	9.10	9.35	9.60	9.85	10.10	10.36
6.65	7.84	8.09	8.35	8.61	8.85	9.11	9.36	9.61	9.86	10.11	10.37
6.70	7.85	8.10	8.36	8.62	8.86	9.12	9.37	9.62	9.87	10.12	10.38
6.75	7.86	8.11	8.37	8.63	8.87	9.13	9.38	9.63	9.88	10.13	10.39
6.80	7.87	8.12	8.38	8.64	8.88	9.14	9.39	9.64	9.89	10.14	10.40
6.85	7.88	8.13	8.39	8.65	8.89	9.15	9.40	9.65	9.90	10.15	10.41
6.90	7.89	8.14	8.40	8.66	8.90	9.16	9.41	9.66	9.91	10.16	10.42
6.95	7.90	8.15	8.41	8.67	8.91	9.17	9.42	9.67	9.92	10.17	10.43

PROPORTIONAL PARTS.

Lactometer fraction.	Fraction to be added to solids not fat.	Lactometer fraction.	Fraction to be added to solids not fat.	Lactometer fraction.	Fraction to be added to solids not fat.
0.1	0.03	0.4	0.10	0.7	0.18
.2	.05	.5	.13	.8	.20
.3	.08	.6	.15	.9	.23

Directions for using the table.—If the specific gravity as expressed in Quevenne degrees is a whole number, the per cent of solids not fat is found at the intersection of the vertical column headed by this number, with the horizontal column corresponding to the per cent of fat. If the specific gravity as expressed in Quevenne degrees is a whole number and a decimal, the per cent of solids not fat corresponding to the whole number is first found, and to that is added the fraction found opposite the tenth under "Proportional parts." Two examples may suffice for illustration: (1) Fat, 3.8 per cent; specific gravity, 1.0320. Under column headed 32, 8.77 per cent is found corresponding to 3.8 per cent fat. (2) Fat, 3.8 per cent; specific gravity, 1.0325. The per cent of solids not fat corresponding

FIG. 3.—Determination of acidity.

to this per cent of fat and a specific gravity of 32 is 8.77. Under "Proportional parts" the fraction appearing opposite 0.5 is 0.13, which, added to 8.77, makes 8.90, the desired per cent.

ACIDITY.

In order to obtain comparable results, it is best to follow strictly the method given in leaflet A 12, previously mentioned. The milk must not be diluted with water, as that causes a perceptible error in the results. Fifty cubic centimeters of milk or cream are taken and titrated against a tenth-normal sodium-hydroxid solution, using phenolphthalein as indicator. Care must be taken near the end of

the titration in order to develop a faint pink color over the entire surface of the milk. The pink color disappears on standing for a short time. The calculation is as follows:

$$\text{Per cent of acidity} = \frac{\text{cc NaOH n/10} \times .009 \times 100}{50}.$$

The following table gives the acidity when 50 cubic centimeters of milk are titrated against tenth-normal alkali:

Determination of acidity in milk.

Cubic centimeters NaOH n/10.	Per cent acidity as lactic acid.	Cubic centimeters NaOH n/10.	Per cent acidity as lactic acid.	Cubic centimeters NaOH n/10.	Per cent acidity as lactic acid.	Cubic centimeters NaOH n/10.	Per cent acidity as lactic acid.
4.0	0.072	7.5	0.135	11.0	0.198	14.5	0.261
4.5	.081	8.0	.144	11.5	.207	15.0	.270
5.0	.090	8.5	.153	12.0	.216	15.5	.279
5.5	.099	9.0	.162	12.5	.225	16.0	.288
6.0	.108	9.5	.171	13.0	.234	16.5	.297
6.5	.117	10.0	.180	13.5	.243	17.0	.306
7.0	.126	10.5	.189	14.0	.252	17.5	.315

SEDIMENT.

The sediment in milk may be determined by means of some form of sediment tester or by observing the bottom of the milk in the bottle. If the sediment tester is used the pint sample of milk should

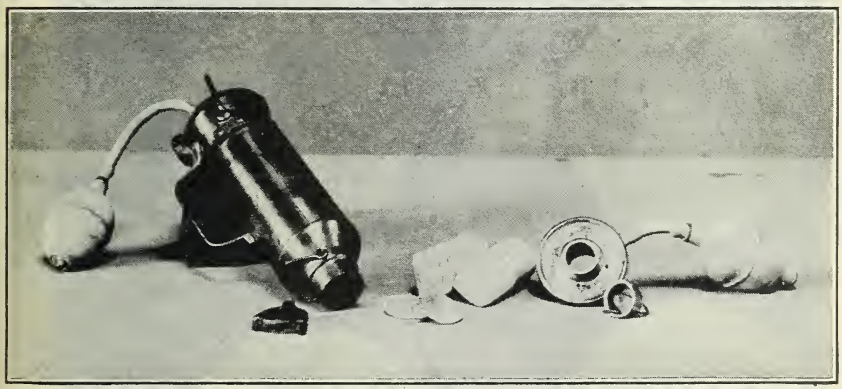

FIG. 4.—Sediment testers.

be warmed slightly before being run through the tester, since cold milk runs through slowly. At the completion of the test the resulting cotton disks are grouped according to the quantity of sediment shown. A perfectly clean cotton scores 10. Figure 5 shows a method of grouping with numerical rating. While the numbers in the figure show a half-point difference only, the analyst can make ratings between these numbers. For example, a cotton disk showing less dirt than 8, but more than 8.5, can be given a rating between 8 and 8.5.

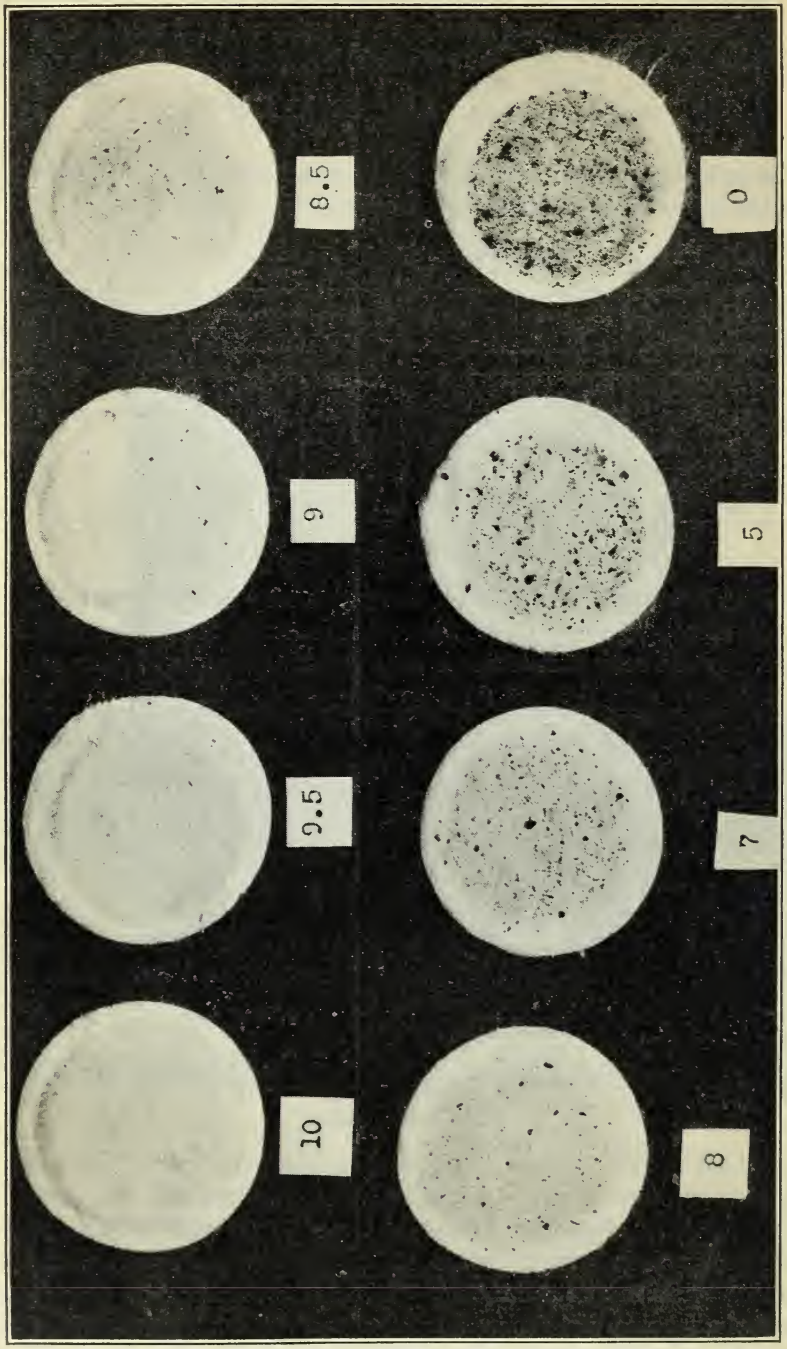

FIG. 5.—Standard disks for sediment determination (actual size). Numbers indicate the score.

Care must be taken to rinse out the tester after each sample has been run through.

It is inadvisable to use the sediment tester for cream, for on account of its heavy viscosity cream may clog the tester entirely. Particles of fat may also obscure any sediment. Sediment in cream should therefore be judged in the bottle. Before scoring, the bottles should be allowed to stand undisturbed for at least an hour to allow any sediment to settle. Then the bottle should be raised carefully, tipping only slightly, so that the bottom can be observed. To score perfect, not so much as a movable speck must be visible in the bottom of the bottle. When sediment is present, points must be deducted according to the quantity.

This bottle method may be used in the same manner for testing the sediment in milk, and the grading shown in figure 5 applies equally in determining the score.

FLAVOR AND ODOR.

The most common "off flavors" and odors found in milk and cream are those produced by certain feeds; by the absorption of foul odors from the stable; and from the presence of foreign substances in the milk. Before scoring, the samples should be set in warm water to warm the milk and cream slightly. The scoring must be done in a room free from odors. The sample of milk or cream should be well mixed before the cap is removed, then about half the contents of the bottle should be poured into a clean beaker. Any odor present can be detected by placing the nose over the mouth of the bottle, and the flavor is judged by taking a little of the product into the mouth. It is not advisable to swallow the liquid if many samples are to be scored, since it tends to reduce the sensitiveness of taste. If the flavor is very bad it can usually be definitely classified. Points are deducted for flavors resulting from strong feeds, and for cowy, strong, bitter, sour, or other off flavors.

BOTTLE AND CAP.

Regulation milk bottles must be used in milk and cream contests and they should be completely filled so that there will be no churning. Deductions in the score are made for dirty or chipped bottles and for caps which do not cover the lips of the bottles or which do not fit properly in the cap seats. To obtain a perfect score the top of the bottle must be covered with parchment paper, metal foil, or some other cover impervious to water and dust.

TEMPERATURE.

In contests where the samples are taken on the street, the temperature of the milk must be recorded at the time the sample is collected, but the sample used for ascertaining temperature must not be taken

for bacterial count. The inspector by previous experiments must determine how long it takes for the mercury in the tube to become stationary and must leave the thermometer bulb in the milk until the mercury has registered the correct temperature. The thermometer should be read, of course, while the bulb is in contact with the milk. Only an accurate thermometer must be used, and care must be taken to prevent breaks in the mercury column. Should such breaks occur they can be corrected by grasping the thermometer in the hand, bulb down, and giving it a long outward sweep, or by placing the bulb in hot water until the mercury has united.

BACTERIAL COUNT.

In the determination of bacteria, the standard methods of bacteriological analysis of milk should be followed. Special care should be taken in the sterilization of glassware and of dilution bottles, and in the preparation of media. Whenever possible three plates should be made. In a contest with prepared samples, the following plates

FIG. 6.—Bottles with protective coverings.

are recommended; Two of $\frac{1}{100}$, and one of $\frac{1}{1000}$. In a contest with street samples it is well to vary this somewhat; as, for example, one of $\frac{1}{100}$, and two of $\frac{1}{1000}$; or two of $\frac{1}{1000}$, and one of $\frac{1}{10000}$. In the latter case, however, the analyst will know from his own experience just what dilutions to make.

A blank containing media and dilution water should be run side by side with the regular samples. Plates must not be poured until the temperature of the melted media averages between 106° and 113° F. (41° and 45° C.). The plates must be left in the incubator for 48 hours, and the temperature of the incubator should be kept at about 100° F. (37.5° C.). For counting colonies, a counting plate and a reading glass magnifying 2½ diameters should be used, and in reporting the counts the standard methods should be strictly followed.

In cities where the continuous contest is in operation, and where the results are averaged every 3, 6, or 12 months, there will be from 4 to 24 bacterial counts to average. It is generally conceded that the arithmetical average may give results which are too high, especially

when one of the counts is much higher than the others. On that account the following table of per cent ratings has been prepared, the use of which, it is thought, will give a fair average of bacteria in counts of 4 or more. Briefly, the method consists in arranging the ratings and not the bacterial counts, and is more fully explained by an example following the table:

Per cent ratings for various bacterial counts.

Bacteria per cubic centimeter.	Rating.	Bacteria per cubic centimeter.	Rating.	Bacteria per cubic centimeter.	Rating.	Bacteria per cubic centimeter.	Rating.
	Per cent.		*Per cent.*		*Per cent.*		*Per cent.*
0	100.0	28,000	76.3	66.000	63.4	140,000	47.0
500	99.0	29,000	75.9	67,000	63.1	150,000	45.1
1,000	97.2	30,000	75.5	68,000	62.9	160,000	43.3
1,500	96.0	31,000	75.1	69,000	62.6	170,000	41.5
2,000	94.6	32,000	74.6	70,000	62.4	180,000	39.8
2,500	93.8	33,000	74.2	71,000	62.1	190,000	38.2
3,000	93.0	34,000	73.9	72,000	61.9	200,000	36.6
3,500	92.2	35,000	73.5	73,000	61.6	210,000	35.1
4,000	91.2	36,000	73.1	74,000	61,4	220,000	33.6
4,500	90.8	37,000	72.8	75,000	61.1	230,000	32.1
5,000	90.2	38,000	72.4	76,000	60.8	240,000	30.6
5,500	89.6	39,000	72.0	77,000	60.6	250,000	29.2
6,000	89.0	40,000	71.6	78,000	60.3	260,000	27.8
6,500	88.6	41,000	71.3	79,000	60.0	270,000	26.5
7,000	88.2	42,000	70.9	80,000	59.8	280,000	25.2
7,500	87.6	43,000	70.6	81,000	59.6	290,000	23.8
8,000	87.2	44,000	70.2	82,000	59.3	300,000	22.4
8,500	86.8	45,000	69.9	83,000	59.1	310,000	21.2
9,000	86.4	46,000	69.6	84,000	58.8	320,000	20.0
9,500	86.0	47,000	69.2	85,000	58.6	330,000	18.8
10,000	85.6	48,000	68.9	86,000	58.3	340,000	17.4
11,000	85.0	49,000	68.6	87,000	58.1	350,000	16.2
12,000	84.4	50,000	68.3	88,000	57.8	360,000	15.0
13,000	83.8	51,000	68.0	89,000	57.6	370,000	13.8
14,000	83.2	52,000	67.6	90,000	57.4	380,000	12.6
15,000	82.6	53,000	67.3	91,000	57.2	390,000	11.5
16,000	82.0	54,000	67.0	92,000	56.9	400,000	10.4
17,000	81.4	55,000	66.7	93,000	56.7	410,000	9.4
18,000	81.0	56,000	66.3	94,000	56.4	420,000	8.2
19,000	80.4	57,000	66.0	95,000	56.2	430,000	7.2
20,000	80.0	58,000	65.7	96,000	56.0	440,000	6.2
21,000	79.4	59,000	65.4	97,000	55.8	450,000	5.2
22,000	79.0	60,000	65.2	98,000	55.6	460,000	4.0
23,000	78.6	61,000	64.9	99,000	55.4	470,000	3.0
24,000	78.2	62,000	64.6	100,000	55.1	480,000	2.0
25,000	77.6	63,000	64.3	110,000	53.0	490,000	1.0
26,000	77.2	64,000	64.0	120,000	50.8	500,000	0.0
27,000	76.8	65,000	63.7	130,000	48.8		

The bacterial average is determined thus: Suppose the following bacterial counts are the result of five counts from samples taken from dairyman "A": 11,000, 65,000, 80,000, 18,000, 450,000. These are arranged in order with their corresponding per cent ratings taken from the table. The ratings are then added and divided by the number of samples.

Bacteria counts.	*Per cent ratings.*
11,000	85.0
65,000	63.7
80,000	59.8
18,000	81.0
450,000	5.2
	5)294.7
	58.9

The average per cent rating is 58.9. By consulting the table it is found that the rating closest to 58.9 is 58.8; therefore the average bacteria count for samples from A's dairy is 84,000. By contrast it may be noted that the arithmetical average of the bacterial counts would be 125,000.

PUBLICITY.

Proper publicity has a valuable place in promoting milk and cream contests. It is not only necessary to give newspaper publicity to prepared contests, but the results of all contests should be announced in a popular, readable way. In prepared contests the names of the winners of each class, with their scores and the prizes won, should always be given. In the continuous contest, when the results are announced at definite periods of time, the winners of prizes with their scores may be given. It is thought advisable, however, in continuous contests to group the dairymen in classes, as A, B, and C, and publish these groupings. For instance, all the dairymen scoring between 90 and 100 could be placed in Class A, those scoring between 80 and 90 in Class B, etc.

In connection with the announcement of winners in contests where the samples are taken on the street, it is advisable to arrange a meeting of producers to discuss in a practical way methods for producing better milk. Consumers may also be interested, not only in publicity but by meetings at which milk questions of interest to them are discussed.